

**PRELIMINARY DRAINAGE ANALYSIS**

**FOR**

**THE OAK COTTAGE OF SANTA BARBARA**  
**1820, 1822, & 1826 DE LA VINA STREET**  
**SANTA BARBARA, CA**

Prepared: August 4, 2010

By:

**InsiteCivil, Inc.**  
615 S. Main Street, Suite D  
Templeton, CA 93465

For:

**Mark and Valerie Maldonado**



## **I. PURPOSE AND SCOPE**

The purpose of this report is to provide a preliminary drainage analysis for the proposed memory care facility located at 1820, 1822, and 1826 De La Vina Street in the City of Santa Barbara, CA. This report will address pre- and post development storm water peak discharge rates, volume reduction and storm water quality as required by the City of Santa Barbara's Storm Water Management Program.

## **II. EXISTING CONDITIONS**

The site consists of three separate assessor's parcels (APN 027-020-022, 023, and 024) with a combined site area of approximately 28,350 square feet. The site is bounded by De La Vina Street to the west and existing residences to the north, south and east. Site topography slopes downhill gradually in a south westerly direction then drops approximately six feet within approximately 12 feet to De La Vina Street. The site is currently developed with six buildings including three residences, two garages, and one shed. Currently, site storm water runoff drains overland to the De La Vina Street gutter (Refer to Exhibit 1).

Based upon the United States Department of Agriculture (USDA) Soil Survey Map for this site, the soils are classified as Hydrologic Soils Group D and are defined as Milpitas-Positas Fine Sandy Loams.

Percolation tests performed by Coast Valley Testing, Inc. on November 5, 2008 yielded an infiltration rate of 1.5 inches per hour (40 min. /in.) (Refer to Exhibit 2).

## **III. PROPOSED CONDITIONS**

The project consists of a proposal to demolish the existing buildings and constructing a two-story 40-unit residential care facility for the elderly with a 9,090 square foot building footprint and 5,590 square feet of covered parking. A new permeable driveway will be constructed along with landscaped areas serving as bioretention areas and filter strips.

## **IV. METHODOLOGY**

The development area was subdivided into watershed areas contributing to each drainage facility (Refer to Exhibit 3).

Hydrology and detention calculations for the site are based on the Santa Barbara County Urban Hydrograph Method (SBUH) for the 25-year storm utilizing the HydroCAD Stormwater Modeling System program developed by HydroCAD Software Solutions LLC.

Infiltration and bioretention sizing calculations are based on the simple sizing method in accordance with the City of Santa Barbara DRAFT – Post Construction Stormwater BMPs, Technical Guidance Manual.

## V. HYDROLOGIC RESULTS

### Existing 25-Year Hydrological Results

The 25-year pre-development peak flow from the project site was calculated to be 1.74 cubic feet per second (Refer to Worksheet No. 1).

### Proposed 25-Year Hydrological Results

The post-development 25-year flow from the project site was calculated to be 1.75 cubic feet per second (Refer to Worksheet No. 2).

NODE	25-YR PEAK DISCHARGE (CFS)
Pond 1P	0.75
Pond 2P	0.33
Subcatchment 3S	0.19
Subcatchment 4S	0.25
Subcatchment 5S	0.23
<b>TOTAL</b>	<b>1.75</b>

Two 30-inch diameter underground pipes (Pond 1P and Pond 2P) are proposed as detention facilities to accommodate the runoff volume from the 25-year storm while releasing a peak flow rate that does not exceed the existing 25-year peak flow rate in accordance with the City of Santa Barbara Storm Water Management Program and the State NPDES General Permit for Storm Water Discharges (Refer to Worksheet No. 2).

## VI. STORM WATER QUALITY AND VOLUME REDUCTION

The runoff volume from the proposed impervious areas resulting from a one-inch storm will be treated by filtering through three bioretention areas. Volume reduction is also accomplished through infiltration into the subsurface soils below the bioretention areas. Calculations demonstrate that the surface areas of the proposed bioretention areas exceed the minimum infiltration requirements (Refer to Worksheet No. 3).

## VII. CONCLUSIONS

### A. Maintaining or Reducing Peak Discharge Rate

The proposed project mitigates increased peak runoff by incorporating underground detention pipes that accommodate the runoff volume from the 25-year storm while releasing a peak flow rate that does not exceed the existing 25-year peak flow rate.

## **B. Runoff Volume Reduction**

Runoff volume reduction is achieved with bioretention areas designed to capture and infiltrate the runoff from the project site for a one-inch storm over a 24-hour period. The results indicate that the area of bioretention provided exceeds the minimum requirements.

## **C. Storm Water Quality Requirements**

Storm water quality requirements are met with landscaped areas serving as bioretention areas, landscaped filter strips, permeable pavers, and trench drains fitted with filters to treat runoff resulting from a one-inch storm prior to discharging into the public drainage system.

## **D. Storm Drainage Conveyance Facilities**

Thru curb drains will provide for positive drainage of runoff, which does not infiltrate into the subsurface soils, onto the existing public street gutters. These proposed thru-curb drains and other pipe culverts will be sized to convey the peak flow from a 25-year storm. Finished grades will be designed to allow for overland release of peak flows resulting from the 100-year storm event to the public streets.

These calculations are based on preliminary plans. Final design may result in modifications to the proposed drainage facilities as required to accommodate the approved site plan and the City's storm water runoff requirements.

# **VIII. Technical Appendix of Supporting Documentation for Calculations**

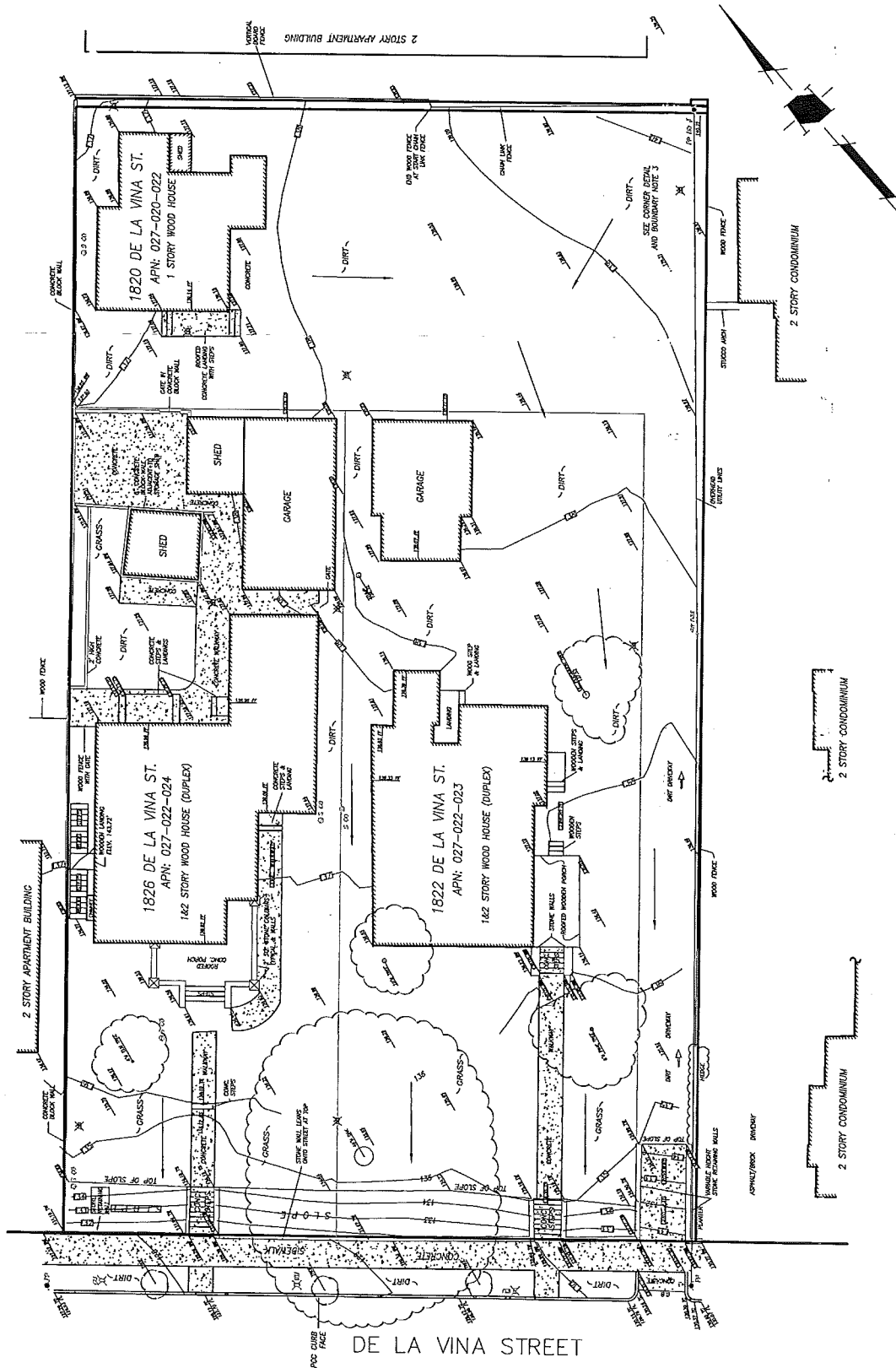
### Exhibits

- 1 - Existing Site Conditions
- 2 - Percolation Tests by Coast Valley Testing
- 3 - Site Drainage Area Map

### Worksheets

- 1 - HydroCAD Summary Report - Existing Runoff Calculations
- 2 - HydroCAD Summary Reports – Proposed Runoff Calculations
- 3 - Design Infiltration and Bioretention Sizing Calculations

## **EXHIBIT #1**



**INSITE CIVIL, INC.**  
Professional Engineering Services  
615 S. Main Street, Suite D, Templeton, CA 93465 (805) 434-3256

THE OAK COTTAGE OF SANTA BARBARA  
1820, 1822, & 1826  
DE LA VINA STREET

EXISTING CONDITIONS  
EXHIBIT 1

Sheet

of Sheet

JOB NUMBER  
090011

## **EXHIBIT #2**

# Coast-Valley Testing, Inc.

Page 1

November 5, 2008  
Order Number: 51398  
Reference Number: 08-6377

Mark Maldonado  
P.O. Box 3007  
Santa Barbara, CA 93130 - 3007

SUBJECT: Performance Tests  
1822 & 1826 De La Vina Street  
Santa Barbara, California

Dear Sir:

In accordance with your request this office performed percolation testing at the subject site in order to determine the suitability of subsurface soils to accept surface water for the design of permeable driveways and/or bio-swales. The tests were performed in 12 inch diameter, pre-saturated borings, using a 6 inch water head. The borings were drilled to depths of 8.0 to 10.0 feet below existing grade. In addition, a six inch diameter boring was drilled to insure no free groundwater or impervious bedrock is located within 10.0 vertical feet of the proposed permeable driveway or bio-swale.

The boring and percolation tests locations are shown on Appendix #1. The results are as follows:

TEST #	DEPTH	PERCOLATION RATE Min/In
1	10.0	40
2	8.0	40

CC: Mark Maldonado  
Lisa Plowman

TJD/cp

Respectfully,  
Coast Valley Testing, Inc.

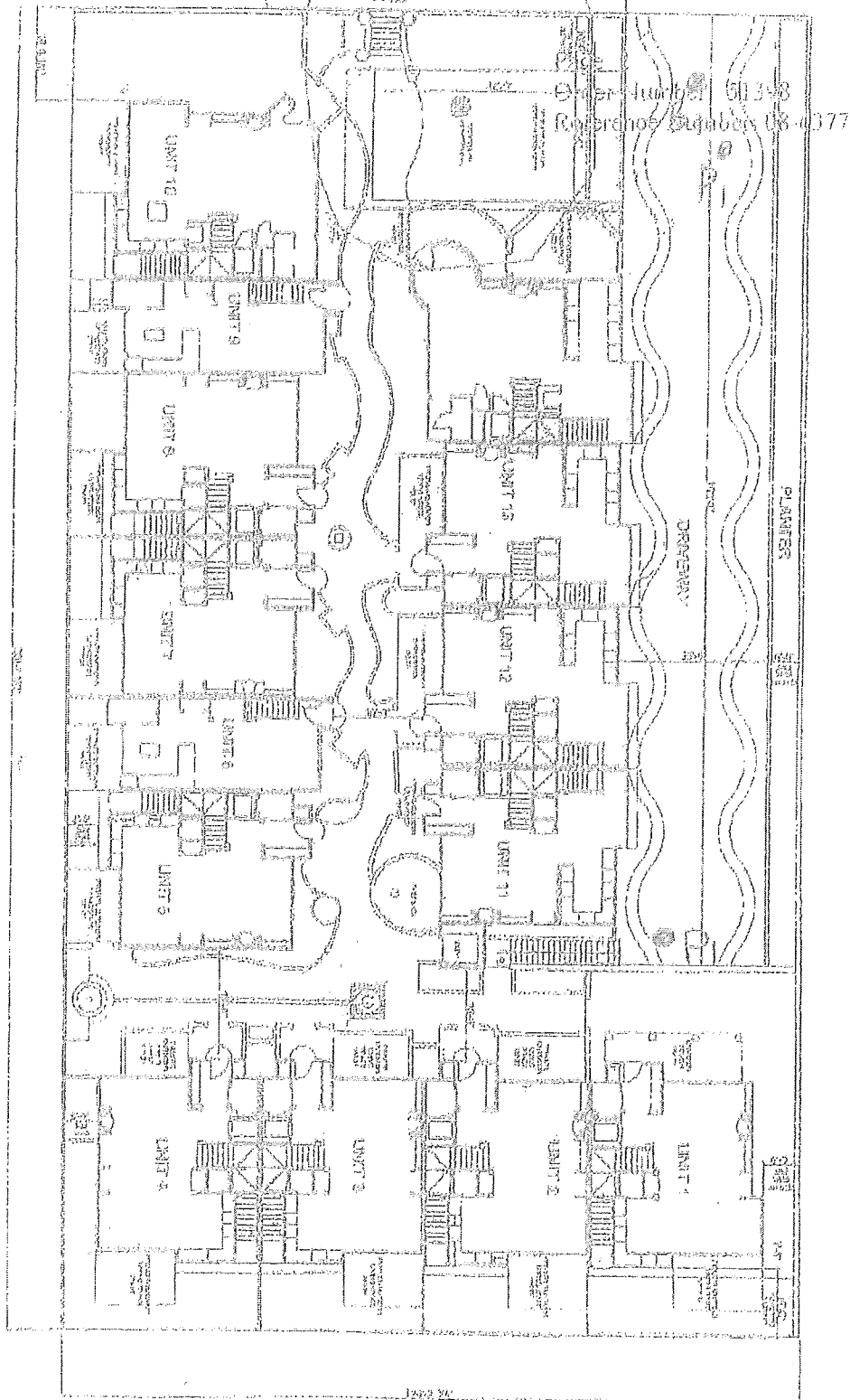
Timothy J. Dolan, President  
RCE #2758 Expires 06-30-2010

360 South Faber Avenue Suite A, Goleta, California 93117  
Goleta Office (805) 964-3509  
Fax (805) 964-9897  
Los Olivos Office (805) 688-3577



# DE LA VINA STREET

Appendix # 1



• APPROXIMATE BORING LOCATIONS  
 AND SCALE

## BORING LOG

Boring # 1

Depth

SOIL DESCRIPTION

1	
2	
3	brown silty sand
4	
5	
6	
7	brown sandy silty clay
8	
9	
10	
11	yellow brown clayey silty sand
12	
13	
14	
15	
16	yellow brown sandy silty clay
17	
18	
19	
20	

No bedrock

No ground water @

20.0 feet

## **EXHIBIT #3**



## **WORKSHEET #1**

# 090011\_Existing Runoff

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 1

## Summary for Subcatchment 1S: Existing Site Runoff

Runoff = 1.74 cfs @ 10.02 hrs, Volume= 0.277 af, Depth> 5.10"

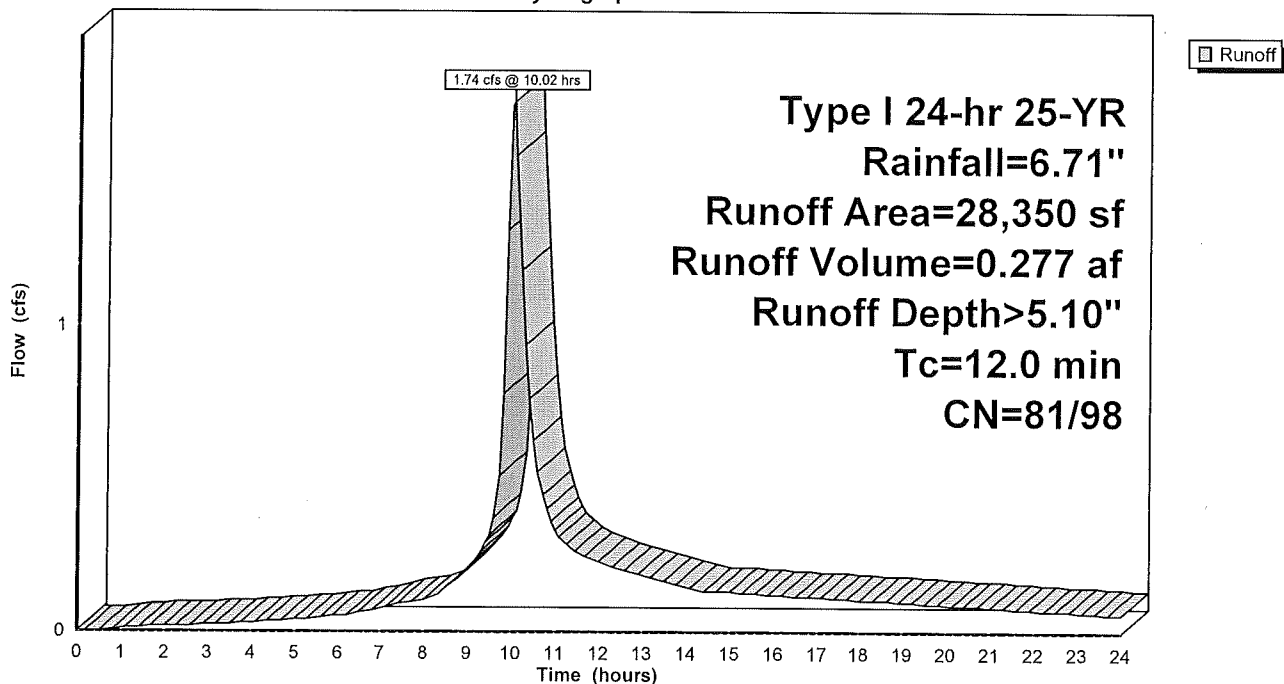
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
Type I 24-hr 25-YR Rainfall=6.71"

Area (sf)	CN	Description
28,350	86	1/3 acre lots, 30% imp, HSG D
19,845	81	Pervious Area
8,505	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

## Subcatchment 1S: Existing Site Runoff

Hydrograph



## **WORKSHEET #2**

**090011\_Proposed Conditions**

Type I 24-hr 25-YR Rainfall=6.71"

Prepared by InsiteCivil, Inc.

Printed 8/4/2010

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Page 1

Time span=0.00-24.00 hrs, dt=0.10 hrs, 241 points

Runoff by SBUH method, Split Pervious/Imperv.

Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

**Subcatchment1S: A1 & A2**Runoff Area=12,156 sf 72.00% Impervious Runoff Depth>5.88"  
Tc=12.0 min CN=80/98 Runoff=0.83 cfs 5,958 cf**Subcatchment2S: A3**Runoff Area=6,472 sf 72.00% Impervious Runoff Depth>5.88"  
Tc=12.0 min CN=80/98 Runoff=0.44 cfs 3,172 cf**Subcatchment3S: A4**Runoff Area=2,783 sf 72.00% Impervious Runoff Depth>5.88"  
Tc=12.0 min CN=80/98 Runoff=0.19 cfs 1,364 cf**Subcatchment4S: A5**Runoff Area=3,599 sf 72.00% Impervious Runoff Depth>5.88"  
Tc=12.0 min CN=80/98 Runoff=0.25 cfs 1,764 cf**Subcatchment5S: A6**Runoff Area=3,340 sf 72.00% Impervious Runoff Depth>5.88"  
Tc=12.0 min CN=80/98 Runoff=0.23 cfs 1,637 cf**Pond 1P: 30" PIPE**Peak Elev=131.16' Storage=0.004 af Inflow=0.83 cfs 5,958 cf  
5.0' x 12.0' Culvert Outflow=0.75 cfs 5,955 cf**Pond 2P: 30" PIPE**Peak Elev=132.00' Storage=0.003 af Inflow=0.44 cfs 3,172 cf  
4.0' x 45.0' Culvert Outflow=0.33 cfs 3,171 cf**Total Runoff Area = 28,350 sf Runoff Volume = 13,895 cf Average Runoff Depth = 5.88"**  
**28.00% Pervious = 7,938 sf 72.00% Impervious = 20,412 sf**



**090011\_Proposed Conditions**

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 2

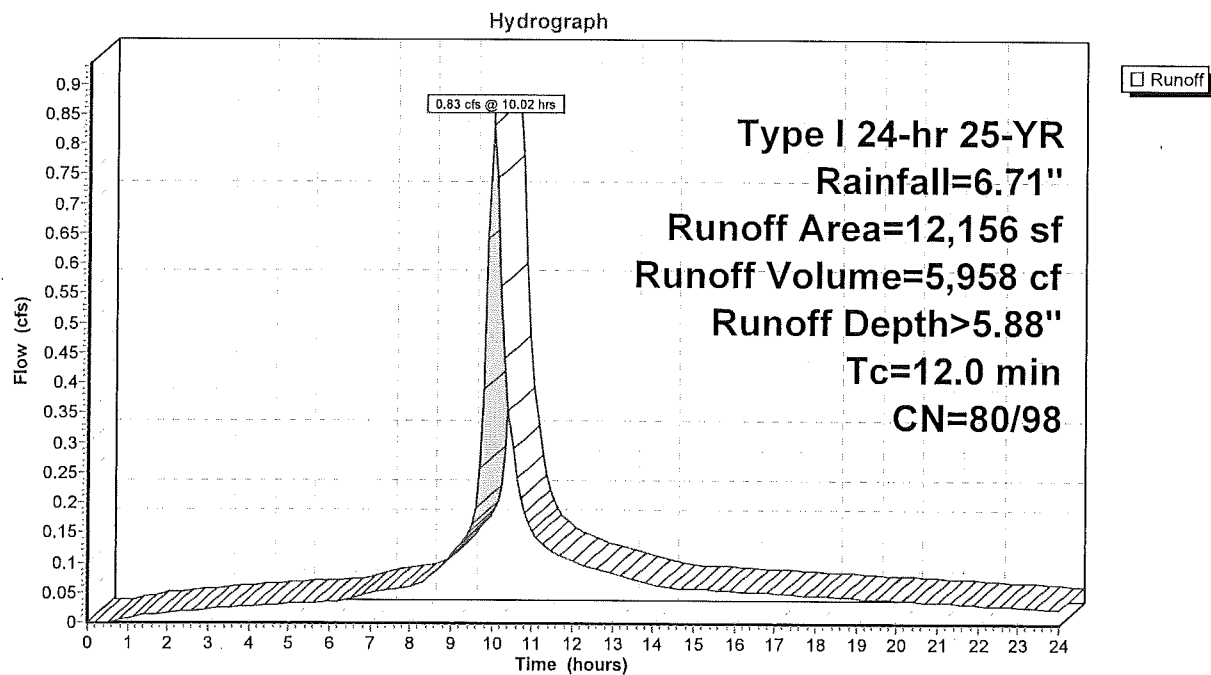
**Summary for Subcatchment 1S: A1 & A2**

Runoff = 0.83 cfs @ 10.02 hrs, Volume= 5,958 cf, Depth&gt; 5.88"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
Type I 24-hr 25-YR Rainfall=6.71"

Area (sf)	CN	Description
12,156	93	Urban industrial, 72% imp, HSG D
3,404	80	Pervious Area
8,752	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

**Subcatchment 1S: A1 & A2**

**090011\_Proposed Conditions**

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 3

**Summary for Subcatchment 2S: A3**

Runoff = 0.44 cfs @ 10.02 hrs, Volume= 3,172 cf, Depth&gt; 5.88"

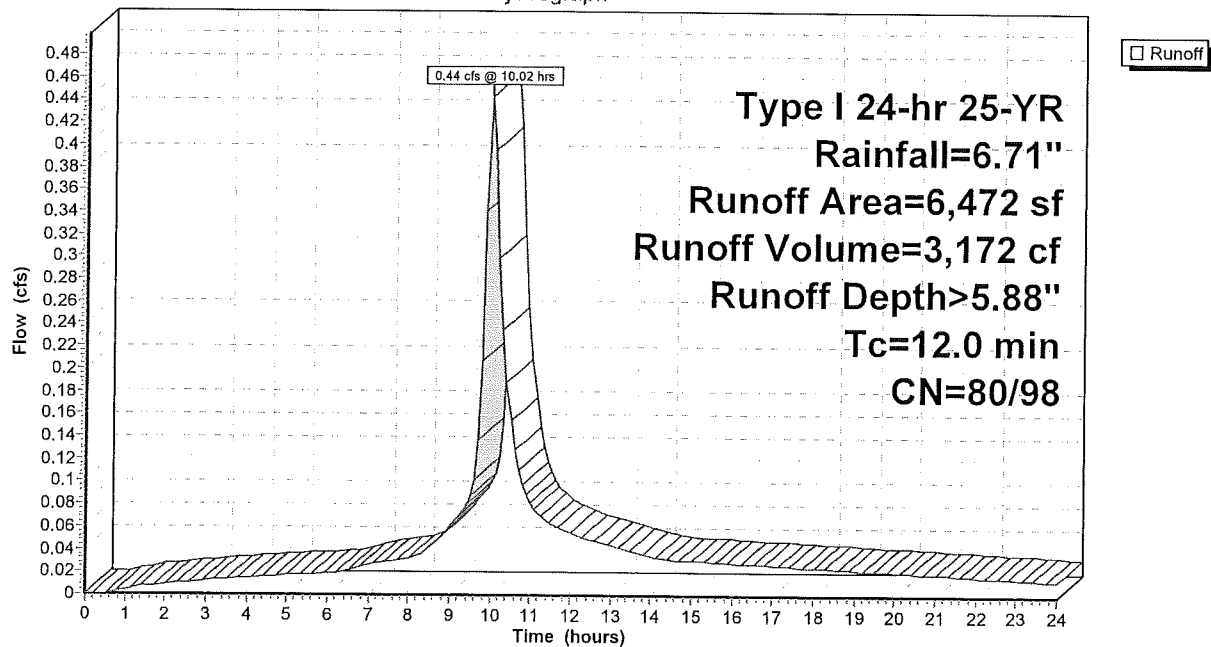
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
Type I 24-hr 25-YR Rainfall=6.71"

Area (sf)	CN	Description
6,472	93	Urban industrial, 72% imp, HSG D
1,812	80	Pervious Area
4,660	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

**Subcatchment 2S: A3**

Hydrograph



**090011\_Proposed Conditions**

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 4

**Summary for Subcatchment 3S: A4**

Runoff = 0.19 cfs @ 10.02 hrs, Volume= 1,364 cf, Depth&gt; 5.88"

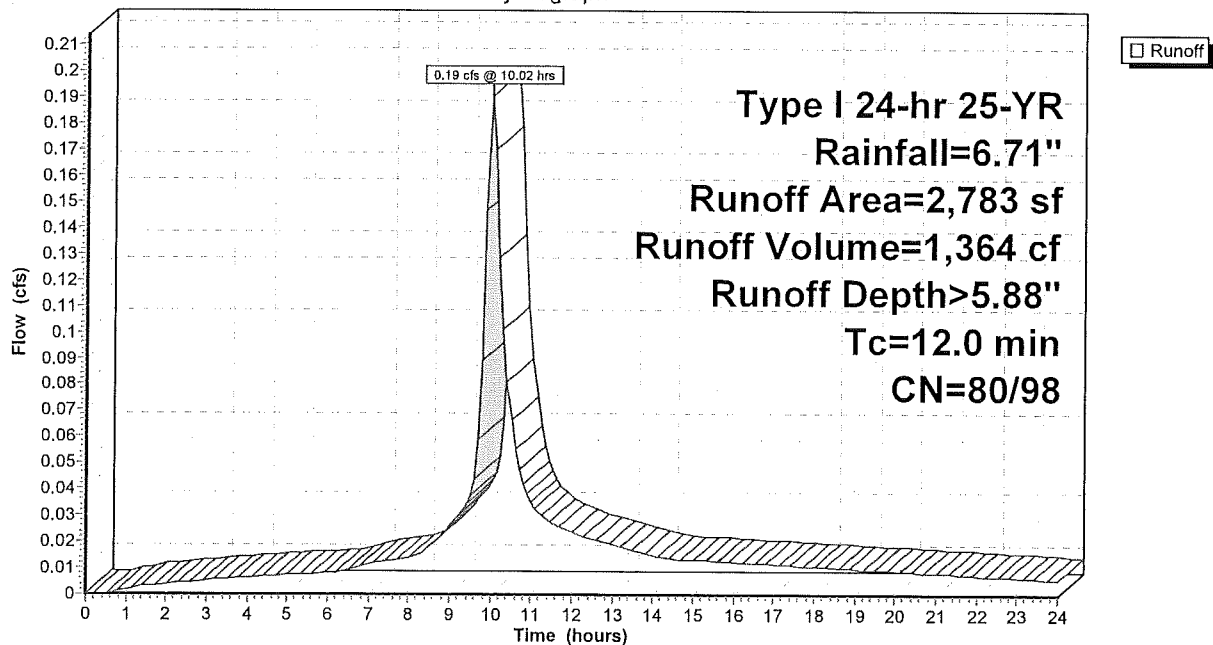
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
Type I 24-hr 25-YR Rainfall=6.71"

Area (sf)	CN	Description
2,783	93	Urban industrial, 72% imp, HSG D
779	80	Pervious Area
2,004	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

**Subcatchment 3S: A4**

Hydrograph



**090011\_Proposed Conditions**

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 5

**Summary for Subcatchment 4S: A5**

Runoff = 0.25 cfs @ 10.02 hrs, Volume= 1,764 cf, Depth&gt; 5.88"

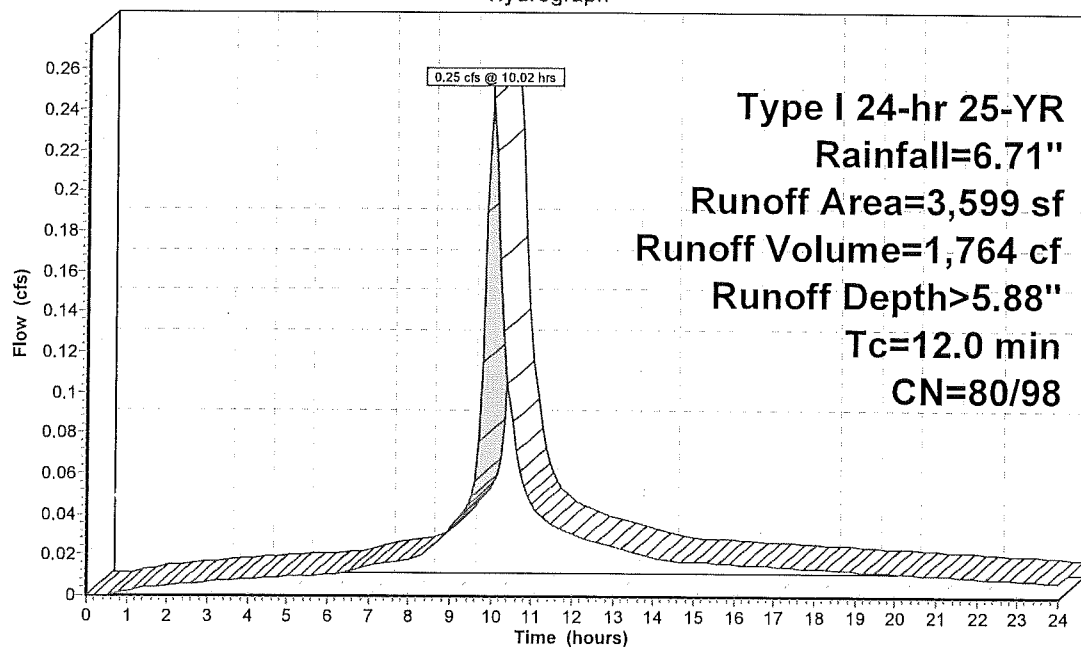
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
Type I 24-hr 25-YR Rainfall=6.71"

Area (sf)	CN	Description
3,599	93	Urban industrial, 72% imp, HSG D
1,008	80	Pervious Area
2,591	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

**Subcatchment 4S: A5**

Hydrograph



**090011\_Proposed Conditions**

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 6

**Summary for Subcatchment 5S: A6**

Runoff = 0.23 cfs @ 10.02 hrs, Volume= 1,637 cf, Depth&gt; 5.88"

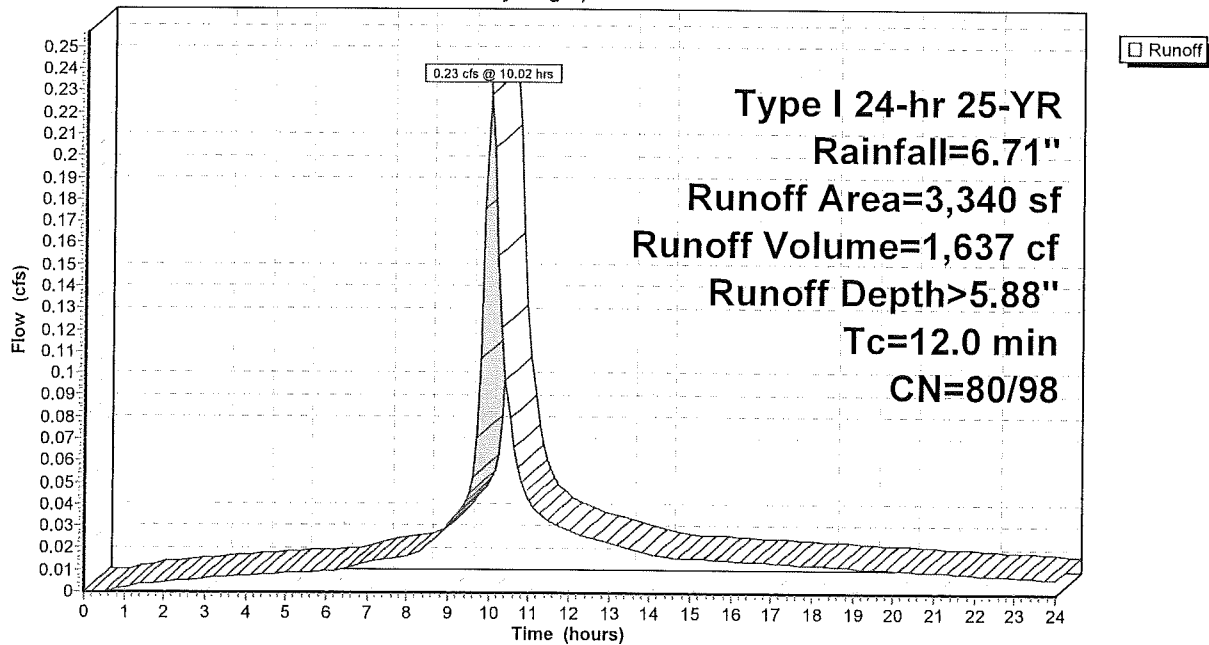
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
Type I 24-hr 25-YR Rainfall=6.71"

Area (sf)	CN	Description
3,340	93	Urban industrial, 72% imp, HSG D
935	80	Pervious Area
2,405	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0					Direct Entry,

**Subcatchment 5S: A6**

Hydrograph



**090011\_Proposed Conditions**

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 7

**Summary for Pond 1P: 30" PIPE**

Inflow Area = 12,156 sf, 72.00% Impervious, Inflow Depth > 5.88" for 25-YR event  
 Inflow = 0.83 cfs @ 10.02 hrs, Volume= 5,958 cf  
 Outflow = 0.75 cfs @ 10.11 hrs, Volume= 5,955 cf, Atten= 11%, Lag= 5.2 min  
 Primary = 0.75 cfs @ 10.11 hrs, Volume= 5,955 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
 Peak Elev= 131.16' @ 10.10 hrs Surf.Area= 0.003 ac Storage= 0.004 af

Plug-Flow detention time= 2.1 min calculated for 5,930 cf (100% of inflow)  
 Center-of-Mass det. time= 1.7 min ( 716.0 - 714.3 )

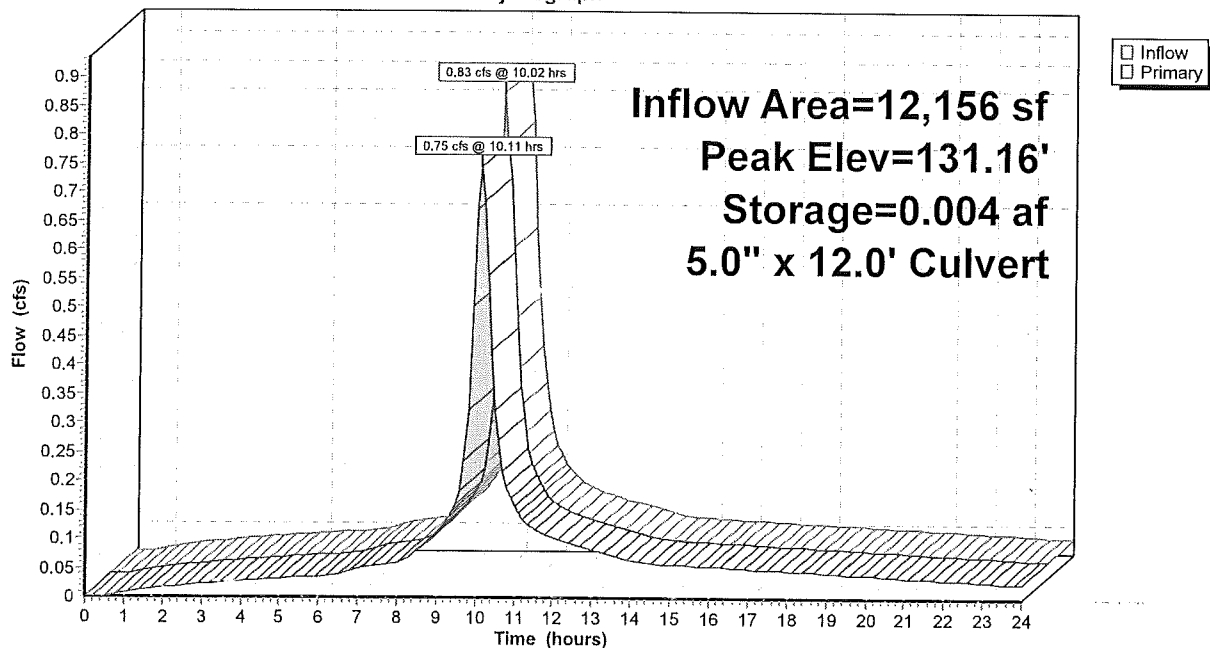
Volume	Invert	Avail.Storage	Storage Description
#1	129.55'	0.005 af	30.0"D x 48.00'L Horizontal Cylinder S= 0.0010 '/'

Device	Routing	Invert	Outlet Devices
#1	Primary	129.55'	5.0" x 12.0' long Culvert CPP, square edge headwall, Ke= 0.500 Outlet Invert= 129.49' S= 0.0050 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=0.74 cfs @ 10.11 hrs HW=131.15' (Free Discharge)  
 1=Culvert (Barrel Controls 0.74 cfs @ 5.44 fps)

**Pond 1P: 30" PIPE**

Hydrograph



**090011\_Proposed Conditions**

Prepared by InsiteCivil, Inc.

HydroCAD® 8.50 s/n 005299 © 2007 HydroCAD Software Solutions LLC

Type I 24-hr 25-YR Rainfall=6.71"

Printed 8/4/2010

Page 8

**Summary for Pond 2P: 30" PIPE**

Inflow Area = 6,472 sf, 72.00% Impervious, Inflow Depth > 5.88" for 25-YR event  
Inflow = 0.44 cfs @ 10.02 hrs, Volume= 3,172 cf  
Outflow = 0.33 cfs @ 10.18 hrs, Volume= 3,171 cf, Atten= 27%, Lag= 9.9 min  
Primary = 0.33 cfs @ 10.18 hrs, Volume= 3,171 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs  
Peak Elev= 132.00' @ 10.18 hrs Surf.Area= 0.003 ac Storage= 0.003 af

Plug-Flow detention time= 2.7 min calculated for 3,171 cf (100% of inflow)  
Center-of-Mass det. time= 2.4 min ( 716.6 - 714.3 )

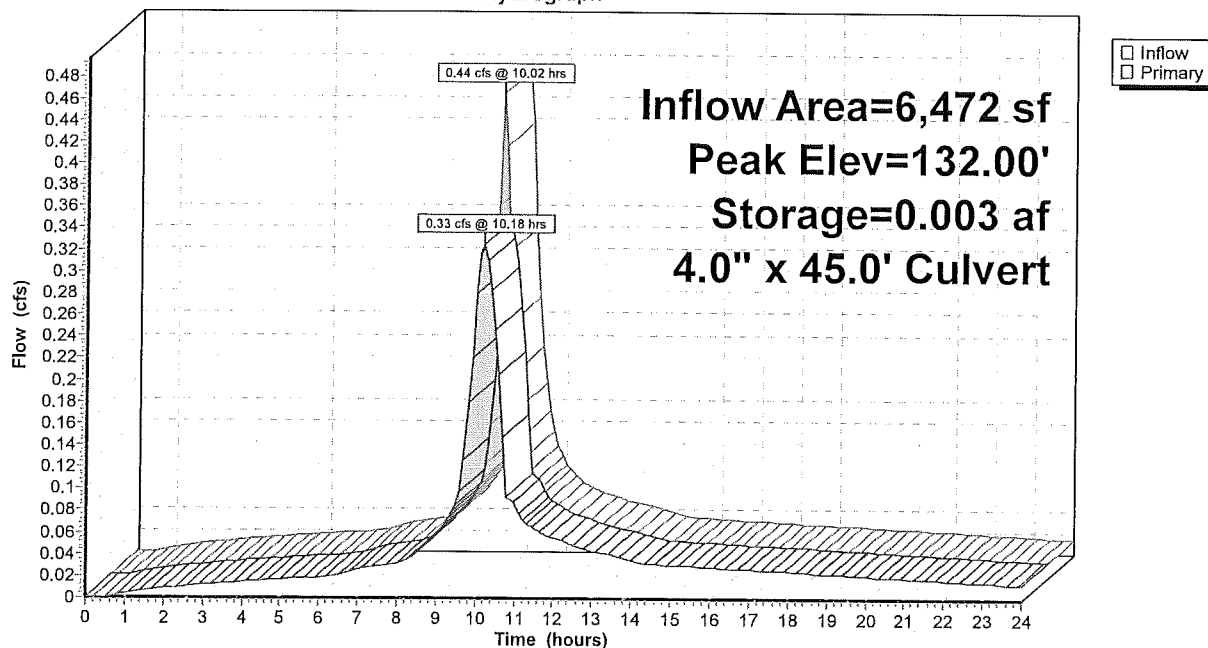
Volume	Invert	Avail.Storage	Storage Description
#1	130.47'	0.005 af	30.0"D x 48.00'L Horizontal Cylinder S= 0.0010 '/'

Device	Routing	Invert	Outlet Devices
#1	Primary	130.47'	4.0" x 45.0' long Culvert CPP, square edge headwall, Ke= 0.500 Outlet Invert= 130.02' S= 0.0100 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=0.32 cfs @ 10.18 hrs HW=131.99' (Free Discharge)  
1=Culvert (Barrel Controls 0.32 cfs @ 3.72 fps)

**Pond 2P: 30" PIPE**

Hydrograph



## **WORKSHEET #3**



<b>DESIGN INFILTRATION RATE</b>		
<b>K<sub>measured</sub></b> , Soil Infiltration Rate	1.5	IN/HR
<b>F<sub>t</sub></b> , Correction Factor for Testing	0.5	
<b>F<sub>p</sub></b> , Correction Factor for Plugging	0.8	
<b>D</b> , Depth to Water Table or Impervious Layer	20	FT.
<b>W</b> , Estimated Width of Facility	3	FT.
<b>F<sub>g</sub></b> , Correction Factor for Geometry (0.25 min, 1.0 max.)	1	
<b>K<sub>design</sub></b> , Design Infiltration Rate	0.6	IN/HR
<b>BIORETENTION AREA NO. 1</b>		
Total Proposed Impervious Area	7456	SF
<b>V<sub>design</sub></b> , One Inch Storm Volume	621	CU.FT.
<b>L</b> , Thickness of Planting Mix	24	IN.
<b>D</b> , Storage Depth Above Filter	3	IN.
<b>K<sub>design</sub></b> , Design Hydraulic Conductivity	0.6	IN/HR
<b>T</b> , Drawdown Time (Use 48 hrs)	48	HR.
<b>A<sub>sf</sub></b> , Required Bioretention Area	230	SF
<b>A<sub>sf</sub></b> , Proposed Bioretention Area	238	SF
<b>V<sub>actual</sub></b> , Volume Reduction Provided	643	CU. FT.
<b>BIORETENTION AREA NO. 2</b>		
Total Proposed Impervious Area	4700	SF
<b>V<sub>design</sub></b> , One Inch Storm Volume	392	CU.FT.
<b>L</b> , Thickness of Planting Mix	24	IN.
<b>D</b> , Storage Depth Above Filter	3	IN.
<b>K<sub>design</sub></b> , Design Hydraulic Conductivity	0.6	IN/HR
<b>T</b> , Drawdown Time (Use 48 hrs)	48	HR.
<b>A<sub>sf</sub></b> , Required Bioretention Area	145	SF
<b>A<sub>sf</sub></b> , Proposed Bioretention Area	558	SF
<b>V<sub>actual</sub></b> , Volume Reduction Provided	1507	CU. FT.
<b>BIORETENTION AREA NO. 3</b>		
Total Proposed Impervious Area	6472	SF
<b>V<sub>design</sub></b> , One Inch Storm Volume	539	CU.FT.
<b>L</b> , Thickness of Planting Mix	24	IN.
<b>D</b> , Storage Depth Above Filter	3	IN.
<b>K<sub>design</sub></b> , Design Hydraulic Conductivity	0.6	IN/HR
<b>T</b> , Drawdown Time (Use 48 hrs)	48	HR.
<b>A<sub>sf</sub></b> , Required Bioretention Area	200	SF
<b>A<sub>sf</sub></b> , Proposed Bioretention Area	255	SF
<b>V<sub>actual</sub></b> , Volume Reduction Provided	689	CU. FT.
<b>SUMMARY</b>		
Total Proposed Impervious Area	18628	SF
<b>V<sub>design</sub></b> , One Inch Storm Volume,	1552	CU.FT.
<b>V<sub>actual</sub></b> , Volume Reduction Provided	2838	CU. FT.
Equivalent Impervious Area	34052	SF
Total Site Area	28350	SF